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PATENT

AMENDMENT IN RESPONSE TO
(OFFICE ACTION DATED FEBRUARY 27, 2003)

REMARKS

Reconsideration of the application in view of the above amendments and the following remarks is requested. Claims 1-3 and 21-37 are in this application. Claims 4-20 have been cancelled. Claims 2-3 have been amended. Claims 21-37 have been added to alternately and additionally claim the present invention. Applicant notes that formal drawings were filed on August 9, 2002, and requests that the Examiner indicate whether these drawings have been received and entered into the application.

The Examiner objected to the drawings under 37 CFR 1.83(a) as not showing every feature of the invention specified in the claims. Specifically, the Examiner noted that a second die that has a MEMS that has an inductance which further includes a MEMS that has a capacitance according to claim 2 must be shown in the drawings or the features cancelled. Applicant notes that claim 2 does not refer to a MEMS, and assumes that the Examiner is referring to claim 3. Applicant proposes to amend FIG. 1 as shown in red on the attached copy of FIG. 1. In addition, applicant has amended the specification to reflect the changes to the drawings.

The Examiner rejected claim 2 under 35 U.S.C. §112, first paragraph, as containing subject matter not disclosed in the specification. Specifically, the Examiner argued that the specification did not disclose a "semiconductor package having a plurality of fourth bonding pads." The Examiner also noted that the specification did not disclose that the "package having a plurality of fourth bonding pads" or multi-layer substrate 210 is made of semiconductor.

It is unclear to applicant what text the Examiner has rejected. Applicant notes that in claim 2, the term "semiconductor package" was intended to identify the object on the package, not the package material, (e.g. a dinner plate is a plate for dinner, not a plate made from dinner). However, for the sake of clarity, claim 2 has been amended to delete the term "semiconductor."

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Regarding the fourth bonding pads, applicant directs the Examiner to page 7, lines 10-15 of the specification, which indicates that integrated circuit package 200 includes a multi-layered substrate 210 that includes a number of package bonding pads 212. Bonding pads 212 shown in applicant's FIG. 2 can be read to be, for example, the plurality of fourth bonding pads recited in claim 2. With these clarifications, the terms of claim 2 are believed to comply with the requirements of 35 U.S.C. §112, first paragraph.

The Examiner rejected claim 3 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that applicant regards as the invention. Specifically, the Examiner questioned whether the micro-electromechanical structure (MEMS) in claim 3 is the same MEMS recited in claim 1, or a second MEMS. Claim 3 has been amended for clarification, and is believed to satisfy the requirements of 35 U.S.C. §112, second paragraph.

The Examiner rejected claims 1-3 under 35 U.S.C. §103(a) as being unpatentable over Wark (U.S. patent 6,399,416) in view of Wolf et al. (*Silicon Processing for the VLSI Era*, Vol. 2, Lattice Press, 2000, pages 826-829). For the reasons set forth below, applicant respectfully traverses this rejection.

Claim 1 recites, in part,

"a first die . . .; [and]
"a second die having:
 " a micro-electromechanical structure having an inductance."
[Brackets added.]

In rejecting the claims, the Examiner points to the Wark reference as teaching all of the limitations of claim 1, except for an interconnect and a passivation layer that are elements of the first die. Specifically, the Examiner points to die 26 shown in FIG. 2 of Wark as constituting the first die required by claim 1, and die 32 as constituting the second die required by claim 1. Applicant, however, can find

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nothing in the Wark reference that teaches or suggests that die 32 includes a micro-electromechanical structure that has an inductance as required by claim 1.

The Examiner appears to argue that it would be obvious to include a micro-electromechanical structure in die 32 because Wark teaches that die 26 "may be any wire-bondable IC die" (see column 4, lines 33-35 of Wark), and that multiple dice 32 can be stacked on top of die 26 rather than the single die 32 shown in FIG. 2 (see column 5, lines 25-27 of Wark). These citations, however, do not render obvious the functions performed by the die.

Electronic devices typically include a printed circuit board (PCB) that has a number of dice electrically connected to the PCB. The dice perform varying functions, and the distribution of functions between individual die depend on a variety of factors, including performance issues, thermal issues, manufacturing issues, and the like.

The Wark reference teaches that by bonding one die to the top of another die, space on the PCB can be saved. This teaching, however, does not render obvious every conceivable distribution of functions between the individual die. For example, assume a PCB includes a first die that performs a first function, a second die that performs a second function, and a third die that performs a third function. If it is discovered that a thermal advantage can be realized by using a fourth die that combines the first and second functions, this discovery is not rendered obvious merely because the third die is bonded to the top of the fourth die to save PCB space.

Similarly, assume that a first die performs both a first function and a second function. If it is discovered that a manufacturing advantage can be realized by using a second die to perform the first function and a third die to perform the second function, this discovery is not rendered obvious merely because the third die is bonded to the top of the second die to save PCB space.

Thus, the teaching that die 26 may be any wire-bondable IC, and that multiple dice 32 can be stacked on top of die 26 does not render obvious a second

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die that has a micro-electromechanical structure. As a result, claim 1 is patentable over the Wark reference in view of the Wolf reference. Further, since claims 2-3 and new claims 21-24 depend either directly or indirectly from claim 1, claims 2-3 and new claims 21-24 are patentable over Wark in view of Wolf for the same reasons as claim 1.

With respect to new dependent claim 23, this claim recites, in part,

"wherein a portion of a third bonding pad is substantially vertically aligned with a portion of a second bonding pad."

Dependent claims 26 and 37 recite similar limitations.

In rejecting the claims, the Examiner points to die 26 shown in an annotated copy of FIG. 2 of Wark (attached to the Office Action) as constituting the first die required by the claims, and bonding pads 26a of die 26 shown in the annotated copy of FIG. 2 of Wark as constituting the plurality of first bonding pads required by the claims. The Examiner also points to bonding pads 26b of die 26 shown in the annotated copy of FIG. 2 of Wark as constituting the plurality of second bonding pads required by the claims.

The Examiner further points to die 32 shown in the annotated copy of FIG. 2 of Wark as constituting the second die required by the claims, and bonding pads 32a of die 32 shown in the annotated copy of FIG. 2 of Wark as constituting the plurality of third bonding pads required by the claims. The Wark reference, however, fails to teach or suggest that a portion of a third bonding pad is substantially vertically aligned with a portion of a second bonding pad as required by claims 23, 26, and 37.

As shown in the annotated copy of FIG. 2 of Wark, second bonding pads 26b are formed on the upper surface of die 26, and third bonding pads 32a are formed on the upper surface of die 32. In addition, third bonding pads 32a are both vertically and horizontally spaced apart from second bonding pads 26b. Since a portion of third bonding pad 32a is not substantially vertically aligned with a portion of second bonding pad 26b, the Wark reference does not teach or suggest the

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limitations of claims 23, 26, and 37. As a result, claims 23, 26, and 37 are patentable over the Wark reference in view of the Wolf reference for these additional reasons.

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With respect to new independent claim 25, this claim recites, in part,

"a passivation layer formed on the interconnect, the passivation layer having a top surface, a center region of the top surface, and a peripheral region of the top surface that surrounds the center region;

"a plurality of first bonding pads formed on the passivation layer only in the peripheral region, the first bonding pads being electrically connected to the interconnect; [and]

"a plurality of second bonding pads formed on the passivation layer only in the center region, the second bonding pads being electrically connected to the interconnect." [Brackets added.]

Dependent claims 22 and 36 recite similar limitations.

As noted above, the Examiner points to die 26 shown in the annotated copy of FIG. 2 of Wark as constituting the first die required by the claims, and bonding pads 26a of die 26 shown in the annotated copy of FIG. 2 of Wark as constituting the plurality of first bonding pads required by the claims. The Examiner also points to bonding pads 26b of die 26 shown in the annotated copy of FIG. 2 of Wark as constituting the plurality of second bonding pads required by the claims.

However, as shown in the annotated copy of FIG. 2 of Wark, bonding pads 26a and 26b are both formed in the periphery of die 26. Thus, since the Wark reference fails to teach or suggest bonding pads which are formed only in a center region, and bonding pads which are formed only in a peripheral region, new claim 25 is patentable over Wark in view of Wolf. Further, since new claims 26-31 depend either directly or indirectly from claim 25, claims 26-31 are patentable over Wark in view of Wolf for the same reasons as claim 25. In addition, dependent claims 22 and 36 are patentable over Wark in view of Wolf for these same reasons.

With respect to new claim 32, this claim recites, in part,

"a package including:

"a substrate having a top surface and a bottom surface, the substrate being attached to the first die;

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"a plurality of fourth bonding pads formed on the top surface of the substrate;

"internal routing electrically connected to the fourth bonding pads; [and]

"a plurality of circuit board connectors formed on the bottom surface of the substrate, the circuit board connectors being connected to the internal routing." [Brackets added.]

Dependent claim 24 also recites that the circuit board connectors are formed on the bottom surface.

In rejecting the claims, the Examiner, citing column 4, lines 46-54 and FIG. 3b of Wark, pointed to die 12 as constituting the package. Applicant notes, however, that Wark teaches that the back side of die 12 and the back side of die 26 are attached with epoxy 28 (see also Wark's FIG. 1). Thus, it is not possible for Wark to have either fourth bonding pads or circuit board connectors on the back side of die 12. As a result, new claim 32 is patentable over Wark in view of Wolf. Further, since new claims 33-37 depend either directly or indirectly from claim 32, claims 33-37 are patentable over Wark in view of Wolf for the same reasons as claim 32. In addition, dependent claim 24 is patentable over Wark in view of Wolf for these same reasons.

Thus, for the foregoing reasons, it is submitted that the drawings and all of the claims are in a condition for allowance. Therefore, the Examiner's early re-examination and reconsideration are requested.

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